NMFS Research and Monitoring Activities

including Responses to
2015 Species Working Group
Recommendations

**Spring Species Working Groups Meeting of the
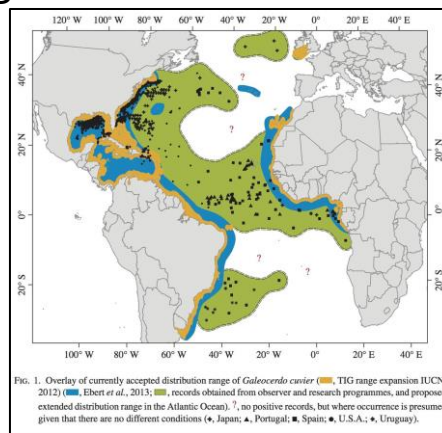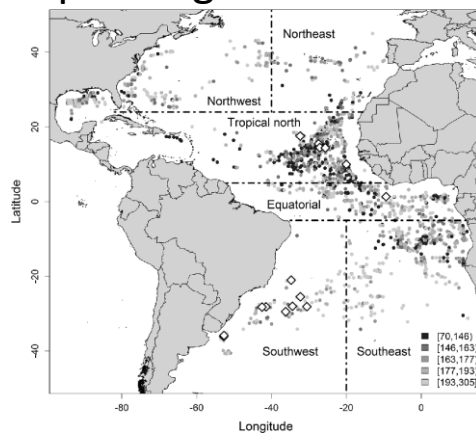Advisory Committee to the U.S. Section to ICCAT**
March 2016

**NOAA
FISHERIES**

**Southeast
Fisheries
Science Center**

Sharks

Shark Life History (ongoing)

Updating age, growth, reproduction, and diet of pelagic species
This information is necessary for eventual revision of ecological risk assessments and for input to stock assessment models.

- Conducting an Atlantic Ocean wide age and growth study for the shortfin mako shark that will contribute to the 2017 ICCAT stock assessment (in collaboration with Portugal, Uruguay, and Japan)

- New publications:
  - Fernandez-Carvalho et al. 2015. Pan-Atlantic distribution patterns and reproductive biology of the bigeye thresher, *Alopias superciliosus*. Rev Fish Biol Fisheries 25:551-568.
  - Domingo et al. 2016. Is the tiger shark *Galeocerdo cuv*ier a coastal species? Expanding its distribution range in the Atlantic Ocean using at-sea observer

FIG. 1. Overlay of currently accepted distribution range of *Galeocerdo cuvieri* (■, TIG range expansion IUCN, 2012) ■ Ebert *et al.*, 2013; ■, records obtained from observer and research programmes, and proposed extended distribution range in the Atlantic Ocean). ?, no positive records, but where occurrence is presumed given that there are no different conditions (♦, Japan; ▲, Portugal; ■, Spain; ●, U.S.A.; ♦, Uruguay).

Habitat Utilization (ongoing)

- Evaluation of closed area to reduce mortality of dusky shark
  - 16 PSAT tags deployed (5 planned for deploy for 2016)
  - Approx 787 days of data received

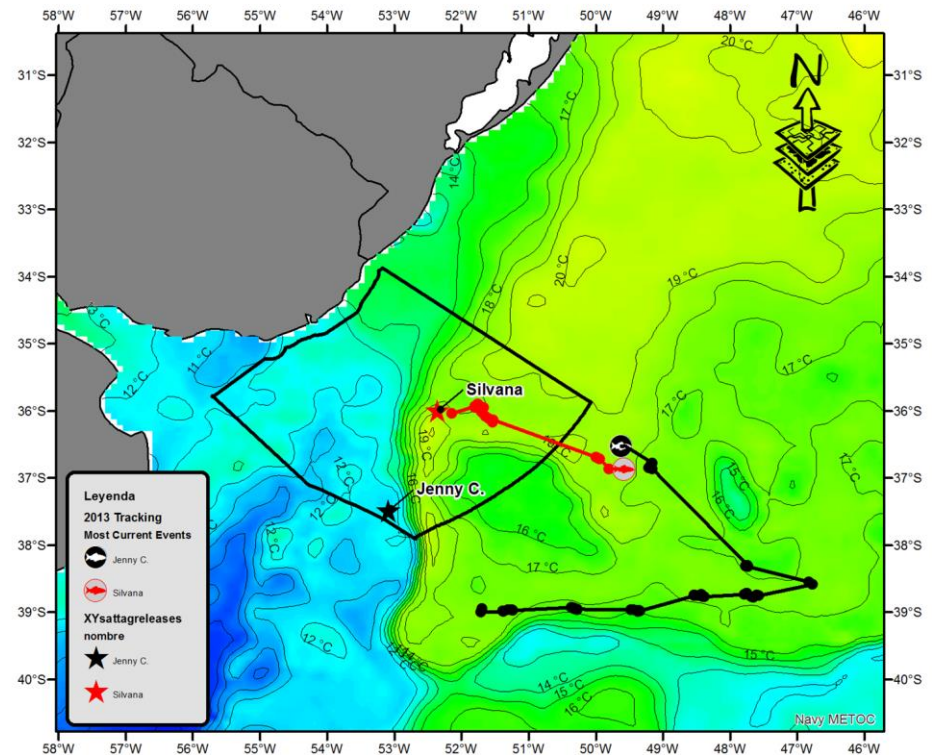- Predicting essential habitat features for oceanic whitetip shark

© Andy Mann
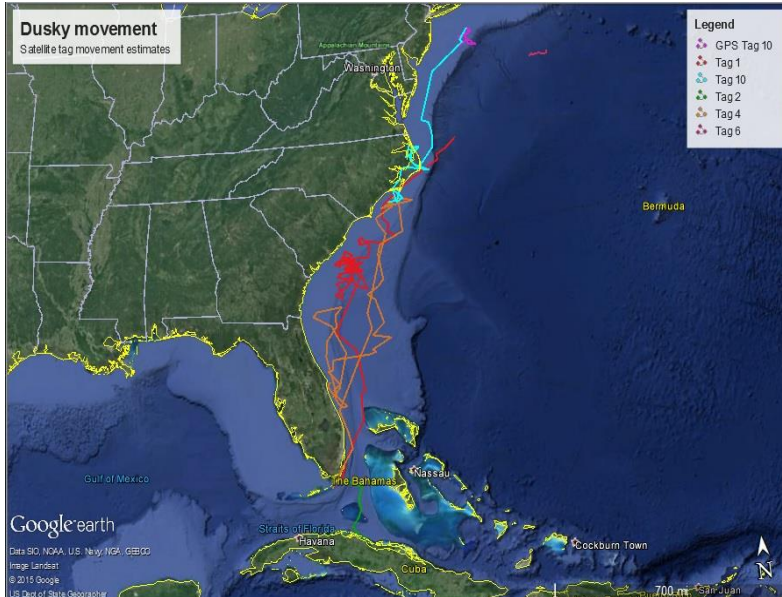
Movement Patterns/Habitat Utilization (ongoing)

- Movement patterns and habitat utilization of blue sharks in the SW Atlantic (collaboration with Uruguay)

12 satellite tags deployed to date

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Movement patterns, habitat utilization, post release survivorship and stock delineation of shortfin mako (with ICCAT Shark WG, particularly Uruguay and Portugal; ongoing)

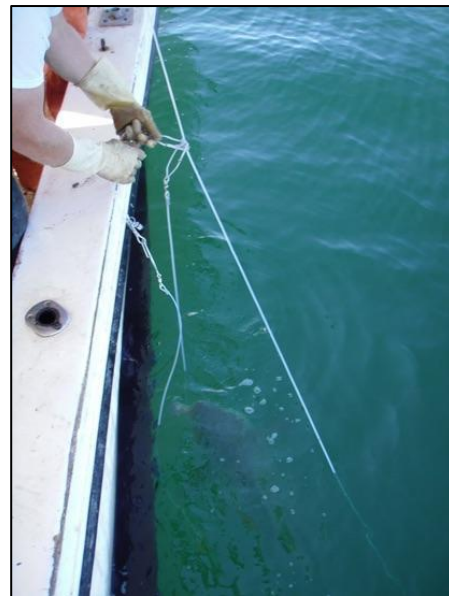NOTE: the collaboration with Uruguay and Portugal includes swordfish
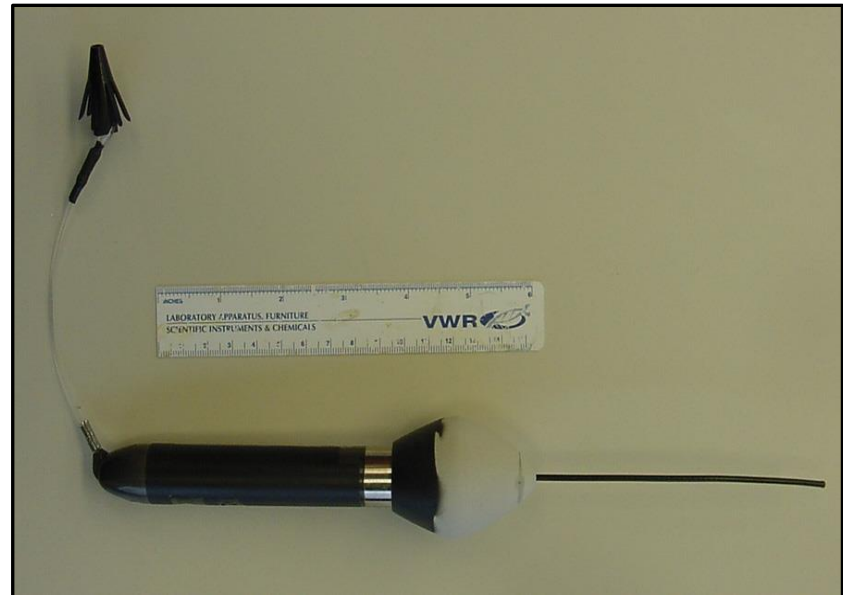
Bycatch reduction

Hooking mortality and post-release survivorship for dusky shark caught on pelagic longline fishing gear (2016)

- Chartered pelagic longline vessel to conduct sets with hook timers
- Dusky sharks captured will be tagged with survivorship pop-off tags

Diel changes in the Catch rates of tuna in the Gulf of Mexico pelagic longline fishery
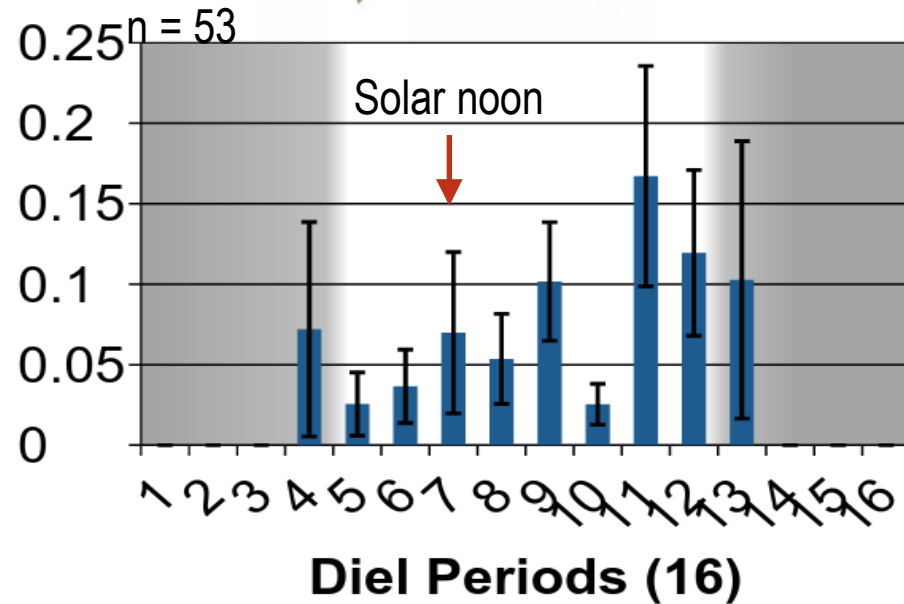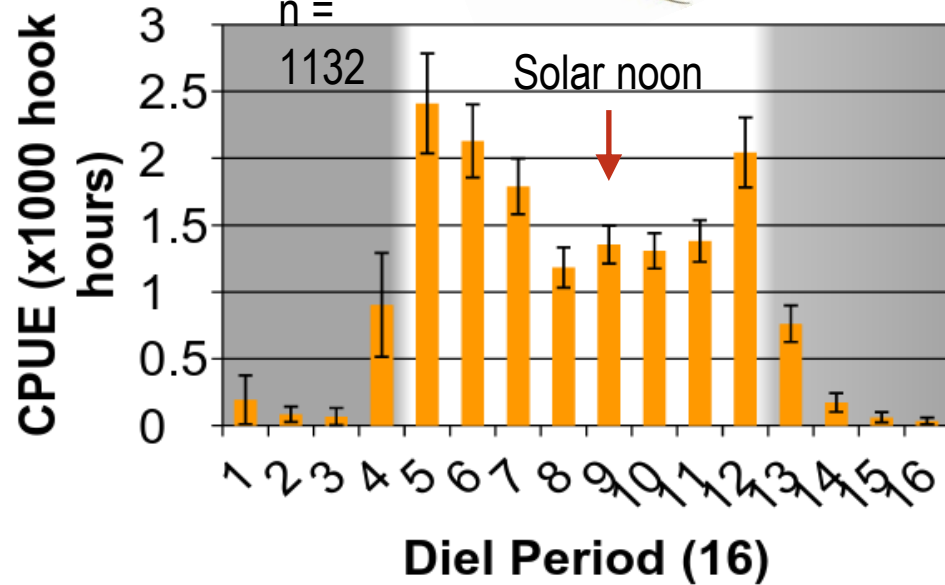
Objective

Analyze hook timer (HTR), temperature and depth recorders (TDR) and pop-up satellite archival tag (PSAT) fishery dependant GOM PLL data to describe the diel changes in the CPUE of targeted yellowfin tuna (*Thunnus albacares)* and bycatch species, and to explore potential methods to reduce bycatch in the fishery.
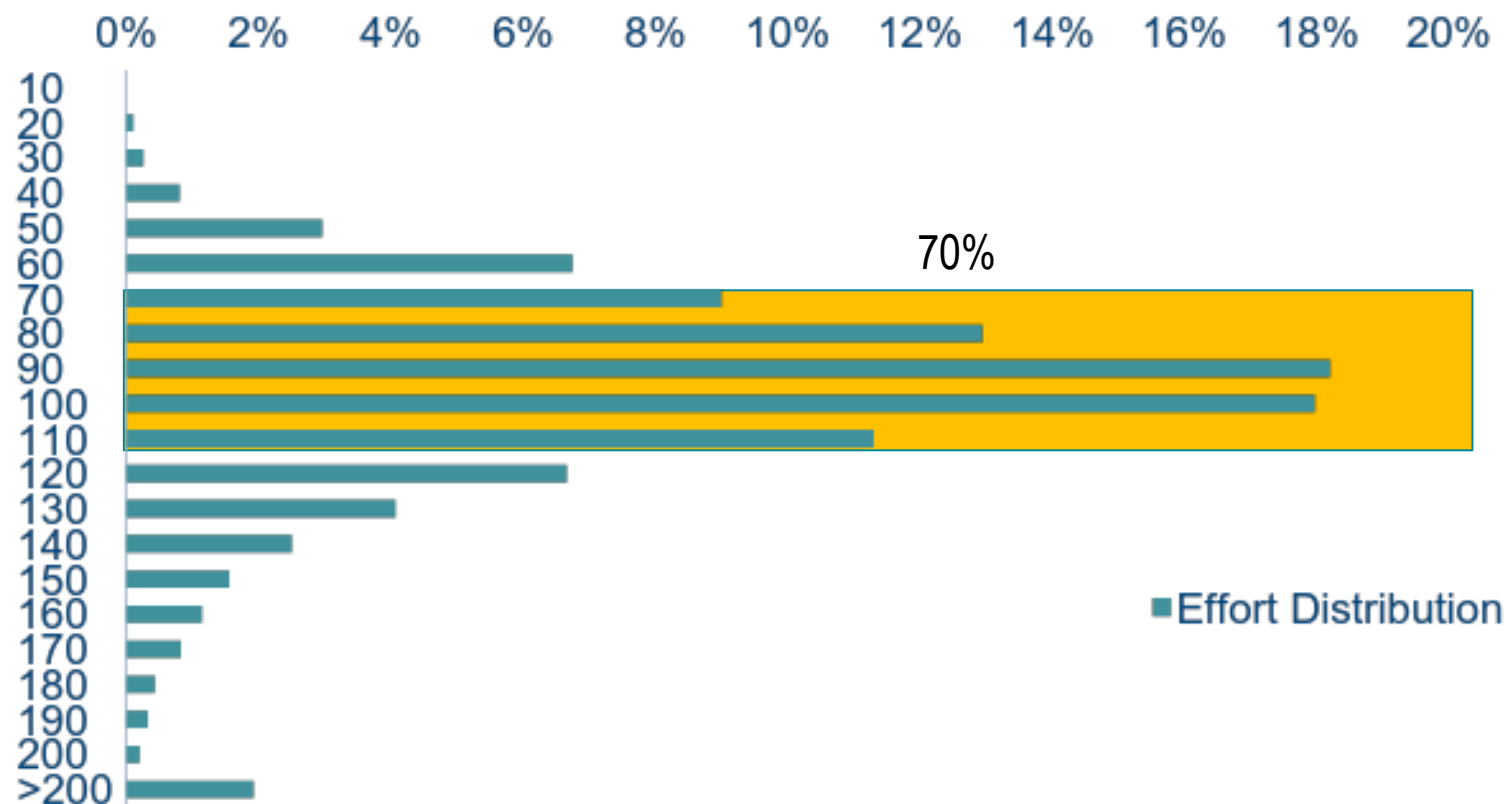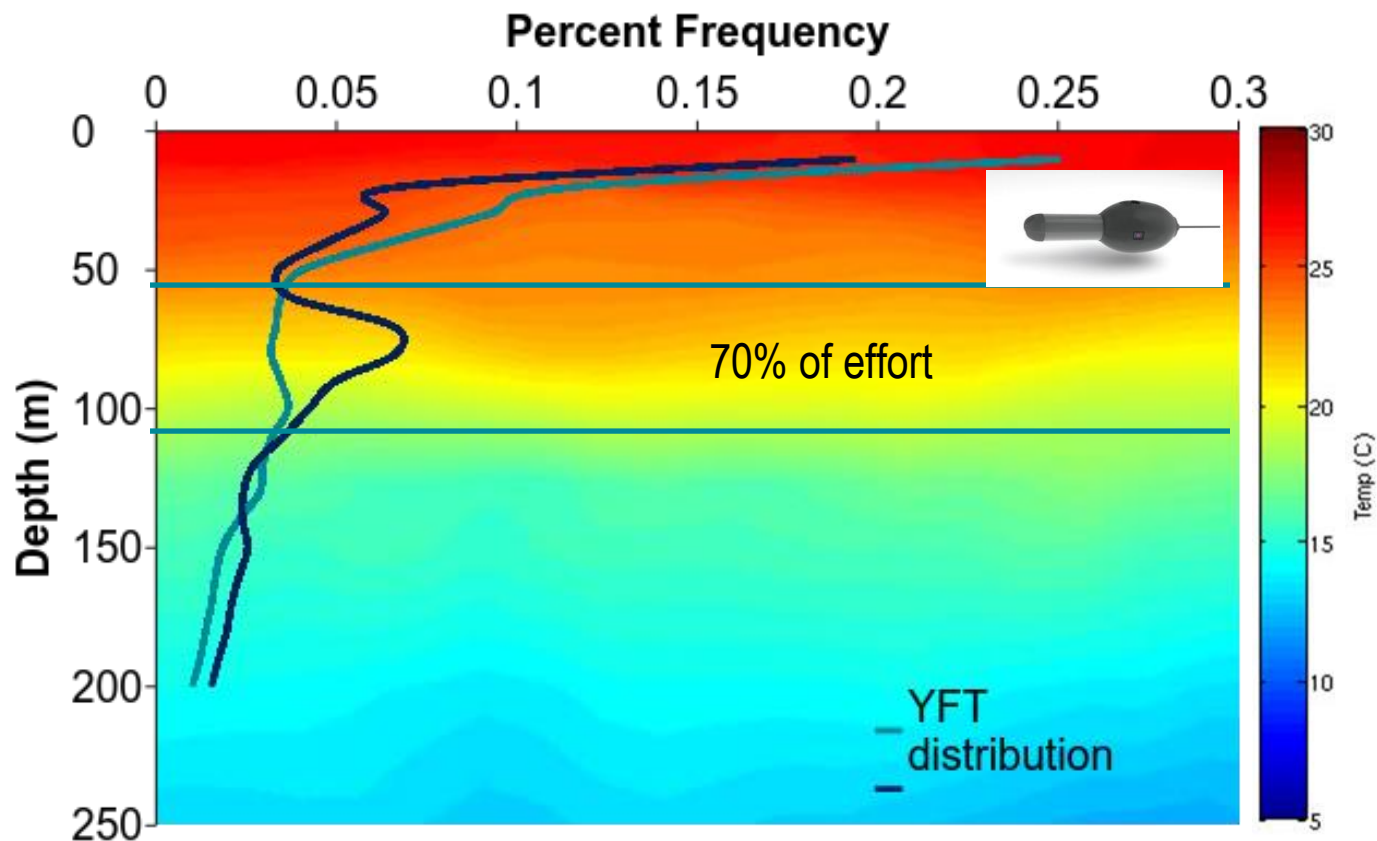
YFT and BFT Mean CPUEs
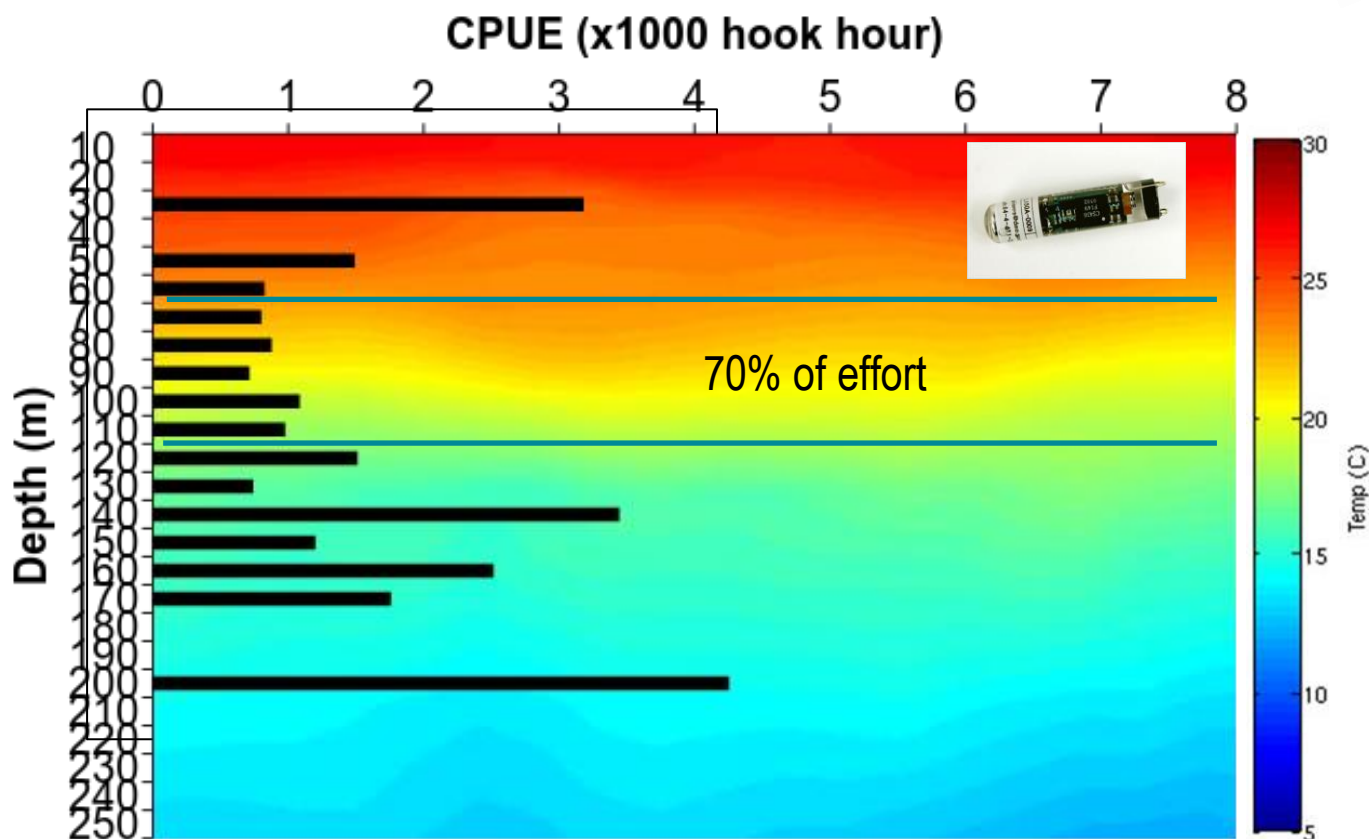
GOM PLL vertical fishing effort

70%

Effort Distribution

Daytime YFT and BFT distribution

70% of effort

YFT
distribution

Daytime YFT Vertical CPUE

70% of effort

YFT n=159

Larval Surveys

AOML · SEFSC
NF-15-02
NF-15-03
NOAA · MEXICO·CUBA · JAMAICA·USVI

Larval fish Research Cruise 2015

Bluefin tuna

Text

18.5

18

Virgin Islands

17.5

USA
Gulf of Mexico
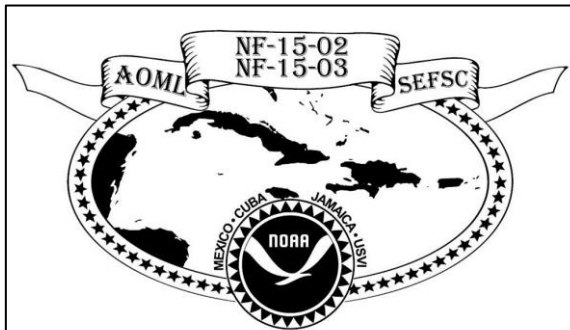
+ 11 – 22 April
+ 25 April – 5 May
+ 9 – 20 May
+ 22 May – 3 June

24

Cuba

Atlantic Ocean

22

Mexico

20

Caribbean Sea

18

Jamaica

-88   -86   -84   -82   -80   -78   -76   -74
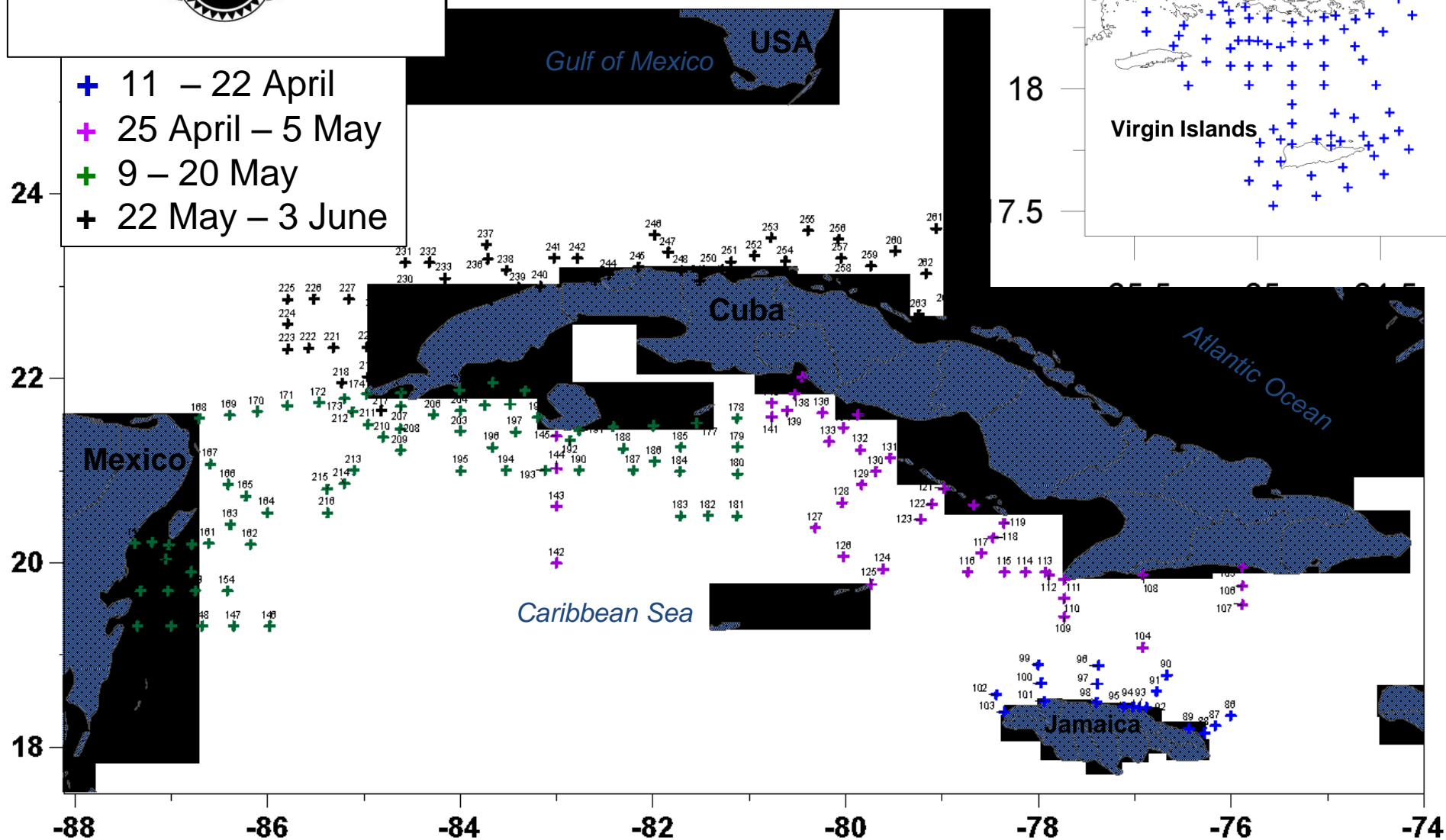
F.O.R.C.E.S. Lab HMS Research

Prey/predator dynamic ~~*collaboration with HMS Division, AOML, Pascagoula Lab, FATE project)*~~

✓ Developing zooplankton ~~dices from GOM (1980s-2000s)~~

✓ Taxonomic ide ~~erstanding of~~ the stock-recru

BFT Modeling

✓ Vertical distribu

✓ Developed GAM ~~and 2012~~

✓ *Next steps*: exa ~~bbean~~
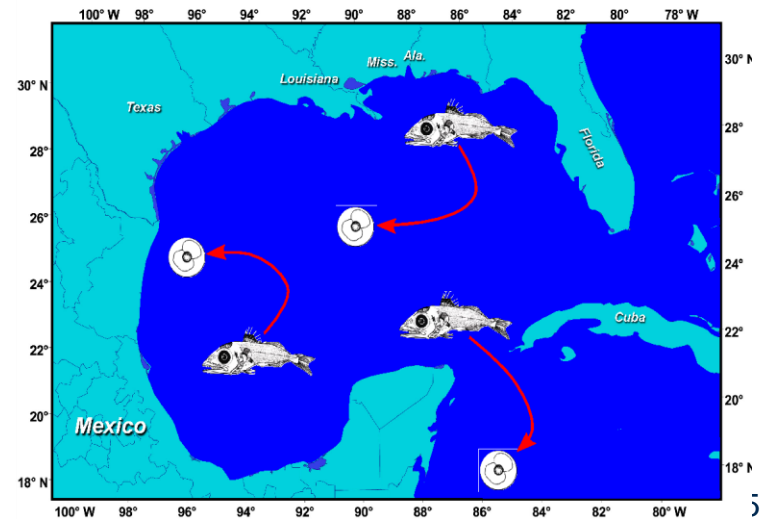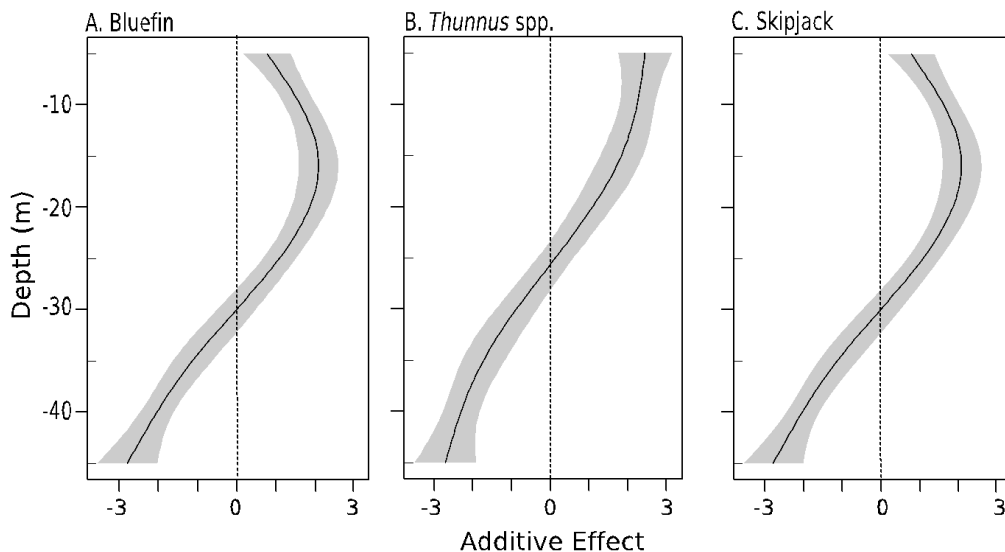
DNA Close-kinship *(in collaboration with NOAA SEFSC HMS division)*

✓ To estimate parentage diversity of larval samples, provided (n~1000) samples from GOM origin to CSIRO (Australia) and VIMS (USA) for genetic analysis from 2011 and 2012
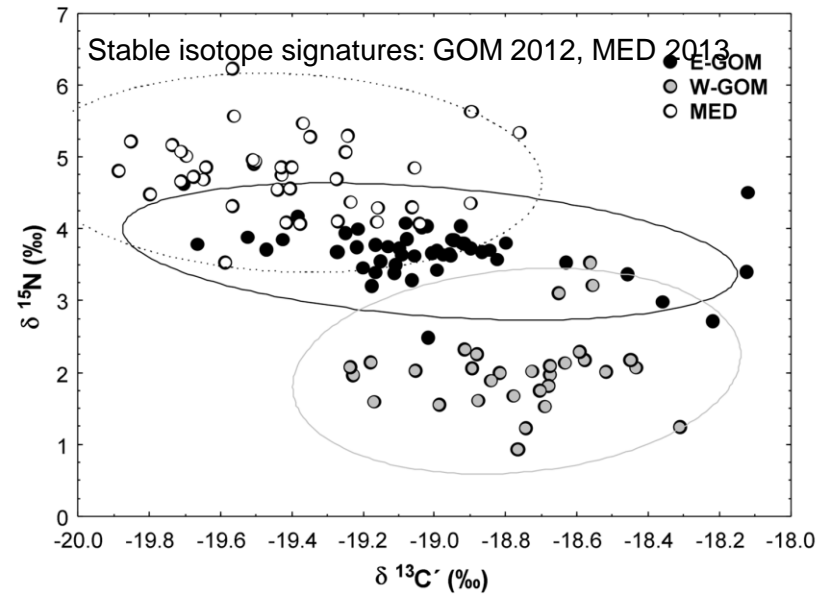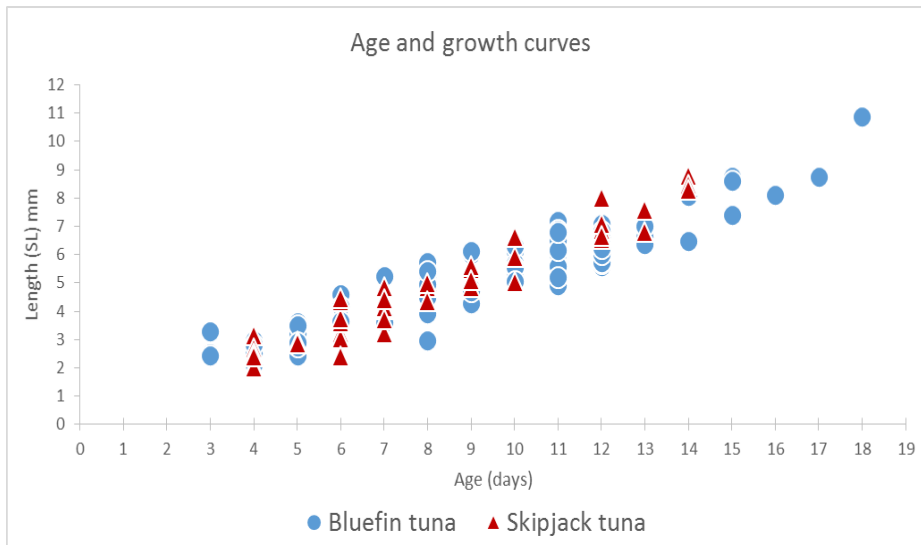
Fisheries Oceanography for Recruitment, Climate, and Ecology Studies

A. Bluefin   B. *Thunnus* spp.   C. Skipjack

Depth (m)   Additive Effect

F.O.R.C.E.S. Lab HMS Research

Ageing

✓ Completion of GOM larval growth curve for 2000-2012 BFT and 2012 skipjack larvae

✓ Preliminary implementation of updated BFT larval growth curve in stock assessments

✓ *Next steps:* spatio-temporal comparisons with ageing of GOM (2013, 2014), Bahamas (2013) and Cuba (2015) BFT larvae (NOAA *BTRP project*)

Trophic web structure and ecology *(in collaboration with IEO, Spain)*

✓ Stable isotopes ($\delta^{15}N$, $\delta^{13}C$) to evaluate BFT, skipjack and blackfin/yellowfin tuna for ecosystem (GOM and MED) comparisons.

✓ Results indicate BFT larvae from the GOM > MED (longer @ same weight) but MED larvae have higher $\delta^{15}N$ values MED > GOM.

✓ $\delta^{13}C$ vs size relationships suggest ontogenetic shifts (diet related) in neritic vs oceanic food sources. *Next steps*: multi-species comparisons using CSIA techniques
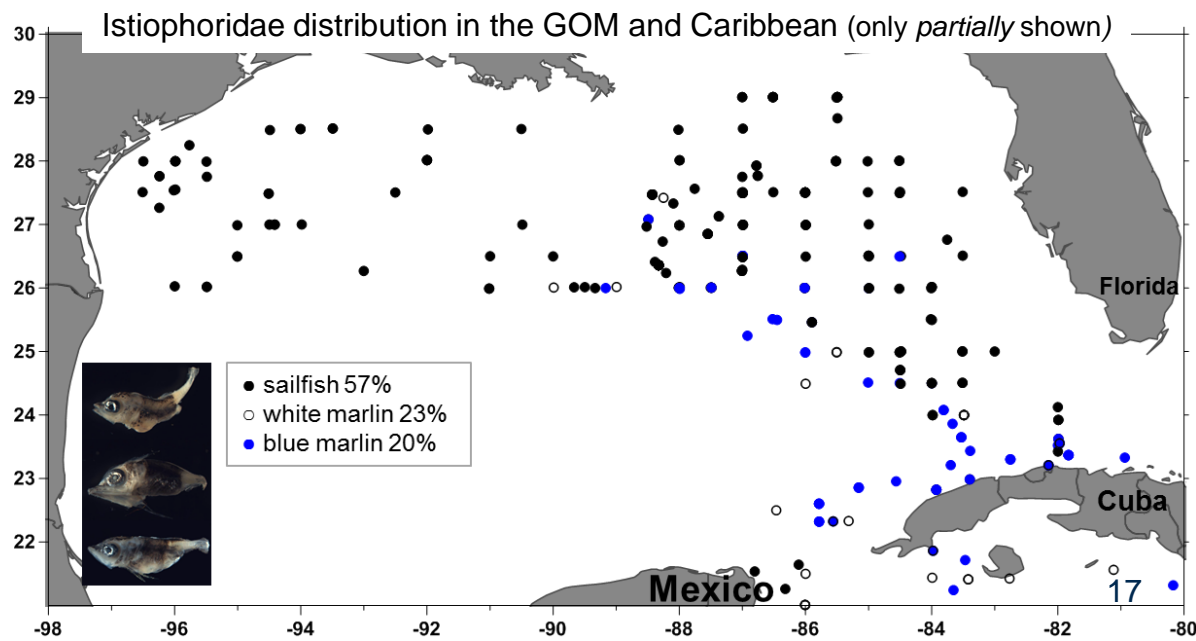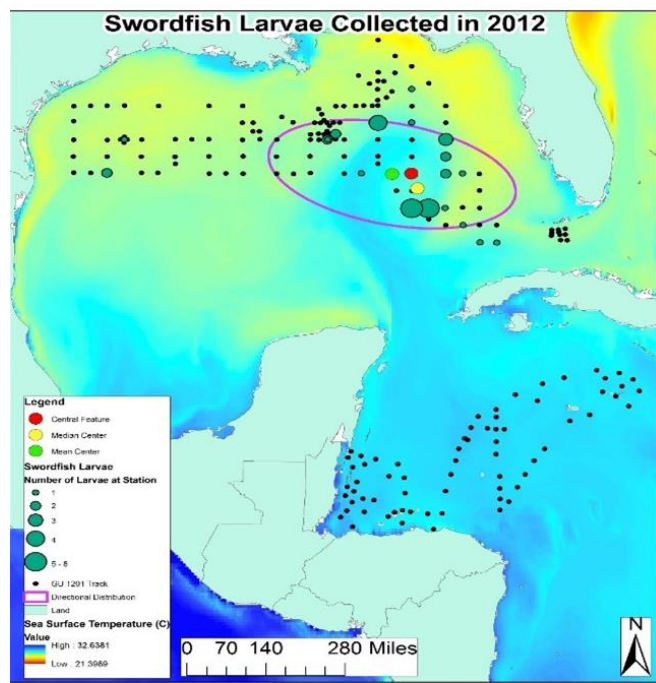

Age and growth curves

Length (SL) mm vs Age (days)

● Bluefin tuna   ▲ Skipjack tuna

Stable isotope signatures: GOM 2012, MED 2013

● E-GOM
◐ W-GOM
○ MED

$\delta^{15}N$ (‰) vs $\delta^{13}C'$ (‰)

F.O.R.C.E.S. Lab HMS Research

Swordfish ecology:

✓ Abundance and horizontal distribution (GOM and W. Caribbean n= 180) from 2010-2012 larval cruises.

✓ Preliminary results indicate presence near the Loop and Yucatán Currents. Next step: develop GAMs to create habitat models for swordfish larvae

Istiophorid ecology:

✓ Genetic identification of 3 species (*K. albida, I. platyperus, M. nigricans*) in 2008, 2010-15

✓ Sailfish were widely distributed in GOM & W. Caribbean, while the marlins (blue and white) were found in the Caribbean Sea and associated with the Loop Current.

✓ Preliminary genetic analysis indicates high variability among blue marlin specimens.

Swordfish Larvae Collected in 2012

Istiophoridae distribution in the GOM and Caribbean (only *partially* shown)

- sailfish 57%
- white marlin 23%
- blue marlin 20%

17

Pelagic Observer Program

Pelagic Observer Program
2015 Gulf of Mexico Enhanced Observer Coverage (GOMEC)

Project Objectives:

- Use available funding to target a 50% observer coverage level. This will produce an expected CV for BFT discard estimates of approximately <= 0.2 (***see NOAA Technical Memorandum NMFS-SEFSC-588***)

- Continue collecting data regarding spatial and temporal patterns of BFT bycatch

- Continue collecting biological samples from landed fish or dead discards

- Satellite tagging of yellowfin catch (reimbursed) and bluefin tuna bycatch (reimbursed).

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Pelagic Observer Program
2015 Gulf of Mexico Enhanced Observer Coverage (GOMEC)

Results: (NON-Experimental)

- Coverage period was February 23rd – June 15th

- 34 observed trips,   275 sets,   21 different vessels, 395 sea days

- Observed Landings: 1,128 YFT   577 SWO   29 BET

- Observed BFT catch/bycatch: 4 landed, 17 released alive,
         3 released dead,   2 lost (26 total)

Pelagic Observer Program
2015 Gulf of Mexico and Atlantic Bluefin Tuna Sampling

Samples made available to researchers in 2015:

Sample Type	#Samples		
	GOMEC	Atlantic	GOM (non GOMEC)
Gonads	8	4	1
Liver	19	5	1
Skin	18	5	1
Otolith	3	1	0
Dorsal Spine	15	5	1
Vertebrae	0	0	0
Muscle	18	5	1
Stomach	0	1	0

*sampling is now being accomplished throughout the year.

Pelagic Longline Effort (millions of hooks)

AWP Max

settlement competency period
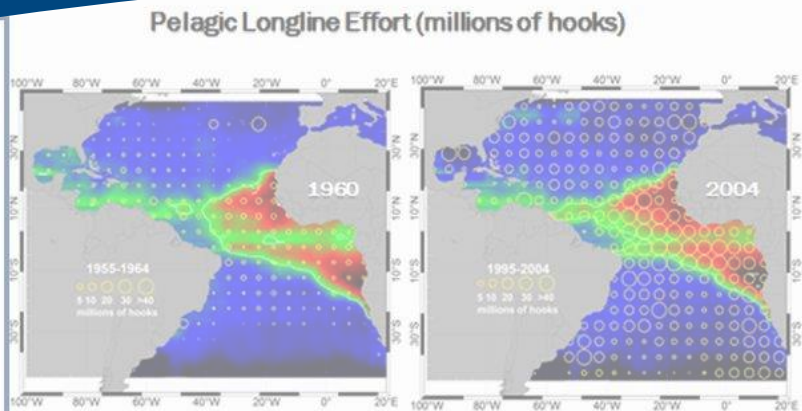
Incorporating a red tide index into the ...del for Gulf of Mexico *...ycteroperca microlepis*)

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Possible environmental indicators for the state of the Atlantic Ocean as it relates to highly migratory species

Indicators serve to:
- depict the state of the Atlantic Ocean
- test various biological hypotheses
- explain process error in biological populations
- improve stock assessments
- lend insight into important considerations for management strategy evaluations

MOC

AMO

Subpolar gyre

NAO

AMM

Ice cover extent

Atlantic Warm Pool

North Equatorial CC transport

Brazil / Agulhas current transport

Sea surface temp

temporal scale: 100 years, 10 years, 1 year, 1 month, 1 day

spatial scale: 1 km, 10 km, 100 km, 1000 km

NOAA FISHERIES

Possible environmental indicators for the state of the Atlantic Ocean as it relates to highly migratory species

temporal scale

- MOC
- AMO
- Subpolar gyre
- AMM
- NAO
- Ice cover extent
- Atlantic Warm Pool
- North Equatorial CC transport
- Brazil / Agulhas current transport
- Sea surface temp

spatial scale

1 km   10 km   100 km   1000 km

The use of multivariate state-space modeling for understanding the influences of environmental factors on stock dynamics

- State equation: $x_t = B_t X_{t-1} + u_t + C_t c_t + w_t; w_t \sim MVN(0, Q_t)$

Observation equation: $y_t = Z_t X_t + a_t + D_t d_t + v_t; v_t \sim MVN(0, R_t)$

Hypothesis of climate-driven poleward shift
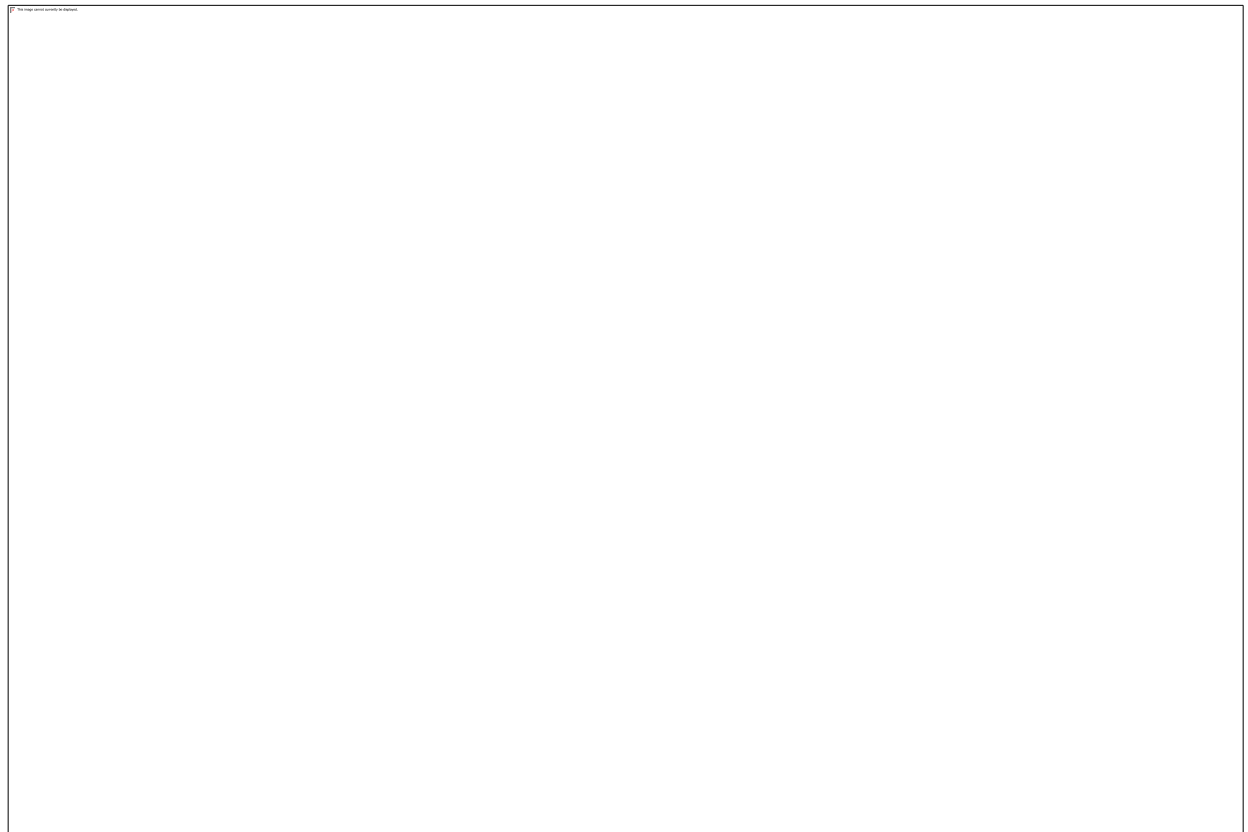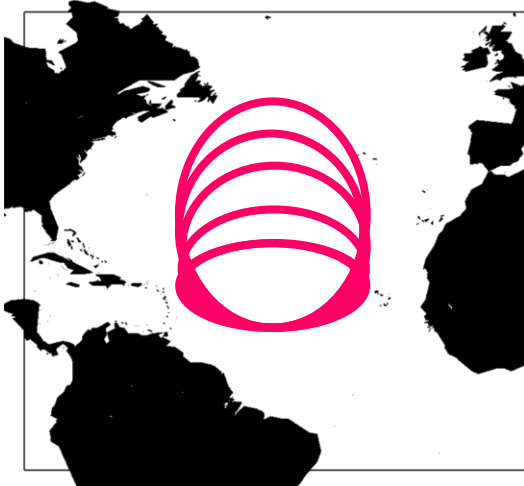
Bluefin Tuna

Update on some SEFSC bluefin tuna research projects

Genetic close-kin project (joint with CSIRO and VIMS)

genetic mark-recapture to estimate spawner abundance

Project underway to evaluate utility of samples from the Spring larval survey.
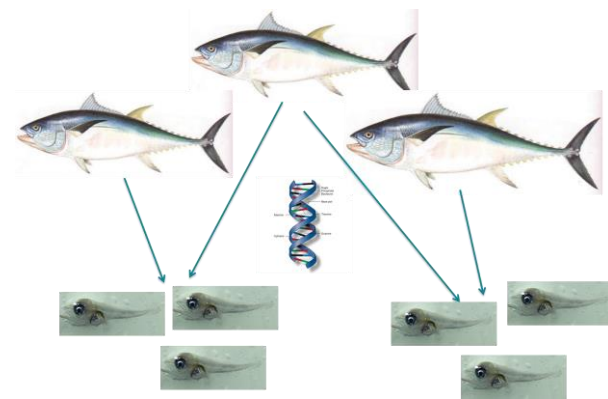
Joint US-Japan-Canada-Mexico longline CPUE indices

Overlap in CPUE across Northwest Atlantic

Scientists from all four countries will meet

this year to conduct joint analyses of data
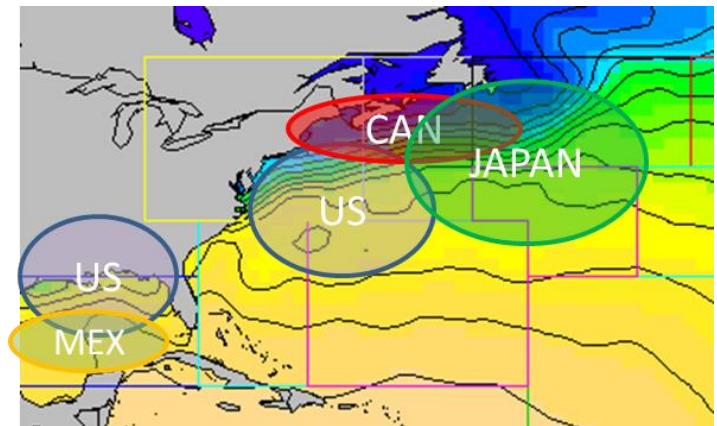
Young of the year (YOY) sampling/survey in Florida Straits

potential for YOY index or to obtain key biological samples

No YOY caught in 2015, but program was delayed due to logistical difficulties

Bluefin 34-43 gillrakers   Blackfin 19-25 gillrakers
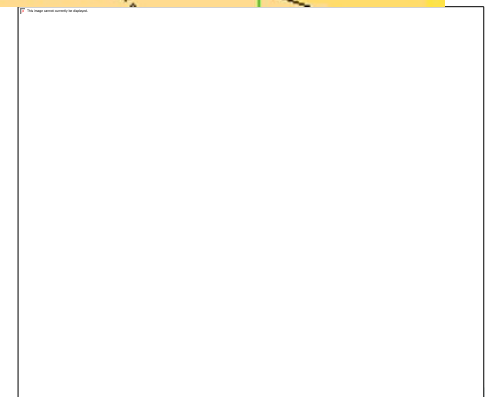
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2010 - 2015 Recreational Sampling Results

NMFS Large Pelagics Biological Survey

Year	No. Fish	Otoliths	Spines	Vertebra	Gonad
2010	32	13	29	27	13
2011	234	218	217	212	58
2012	235	220	206	185	55
2013	116	107	106	103	30
2014	150	147	142	142	25
2015	181	176	160	160	28
Grand Total	948	881	860	829	209

North Carolina Biological Survey

Year	No. Fish	Otoliths	Spines	Vertebra	Gonad
2014	29	29	8	11	1
2015	14	14	0	3	12

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NOAA-sponsored BFT Research

- ICCAT Atlantic-wide Bluefin Tuna Research Program (GBYP)

The EU will contribute up to 80% of funds to GBYP, but requires other CPCs to contribute matching funds directly to ICCAT

U.S. direct funding contributions are therefore important to leverage funding from the EU

U.S. direct funding contributions to ICCAT GBYP

Year	Amount
2011	$175,000
2012	$250,000
2013	$0
2014	$70,000
2015	~$126,000

Direct funding contributions from NOAA Fisheries were suspended beginning in 2013 as the agency does not appear to have statutory authority to send money directly to ICCAT. Contributions for 2014-2015 were from the State Dept.

NOAA-sponsored BFT Research

- U.S. Bluefin Tuna Research Program (BTRP - NOAA grants to fund extramural research (e.g. genetic studies, tagging etc.)

2011	$510,000
2012	$730,000
2013	$685,000
2014	$652,000
2015	$541,000

The FY2016 BTRP selections have not been completed

NOAA-sponsored BFT Research: FY2015 BTRP Projects

Improving the Atlantic Bluefin Tuna Assessments by Providing Better Information on Age Composition
John Hoenig   VA Institute of Marine Science $118,760.00

Measuring Larval Bluefin Tuna Growth to Improve a Fishery-Independent Index, and Help Resolve Uncertainty with the Stock-Recruitment Relationship
Barbara Muhling   University of Miami, RSMAS $88,413.00

Biological Sampling to Determine Age, Growth and Sex of Atlantic Bluefin Tuna in the NW Atlantic
Walt Golet   University of Maine System $181,642.00

Operational Use of Otolith Chemistry to Inform Stock Assessment and Forward Projection Of Atlantic Bluefin Tuna Populations
Lisa Kerr   Gulf of Maine Research Institute $154,268.00

Development and Application of Mixed-Stock Models for Determining the Origin of Bluefin Tuna using Natural Geochemical Tags
Jay Rooker   Texas A&M University Galveston $116,909.00

NOAA-sponsored BFT Research

- Contracts (active in 2016)

$700,000	Expanded observer coverage in Gulf of Mexico
$100,600	Large Pelagic Biological Survey
$27,350	North Carolina Biological Survey
(funded in 2015)	Next-of-kin analysis

- Southeast Fisheries Science Center research (not described previously)

    GOM longline release mortality study (ongoing)
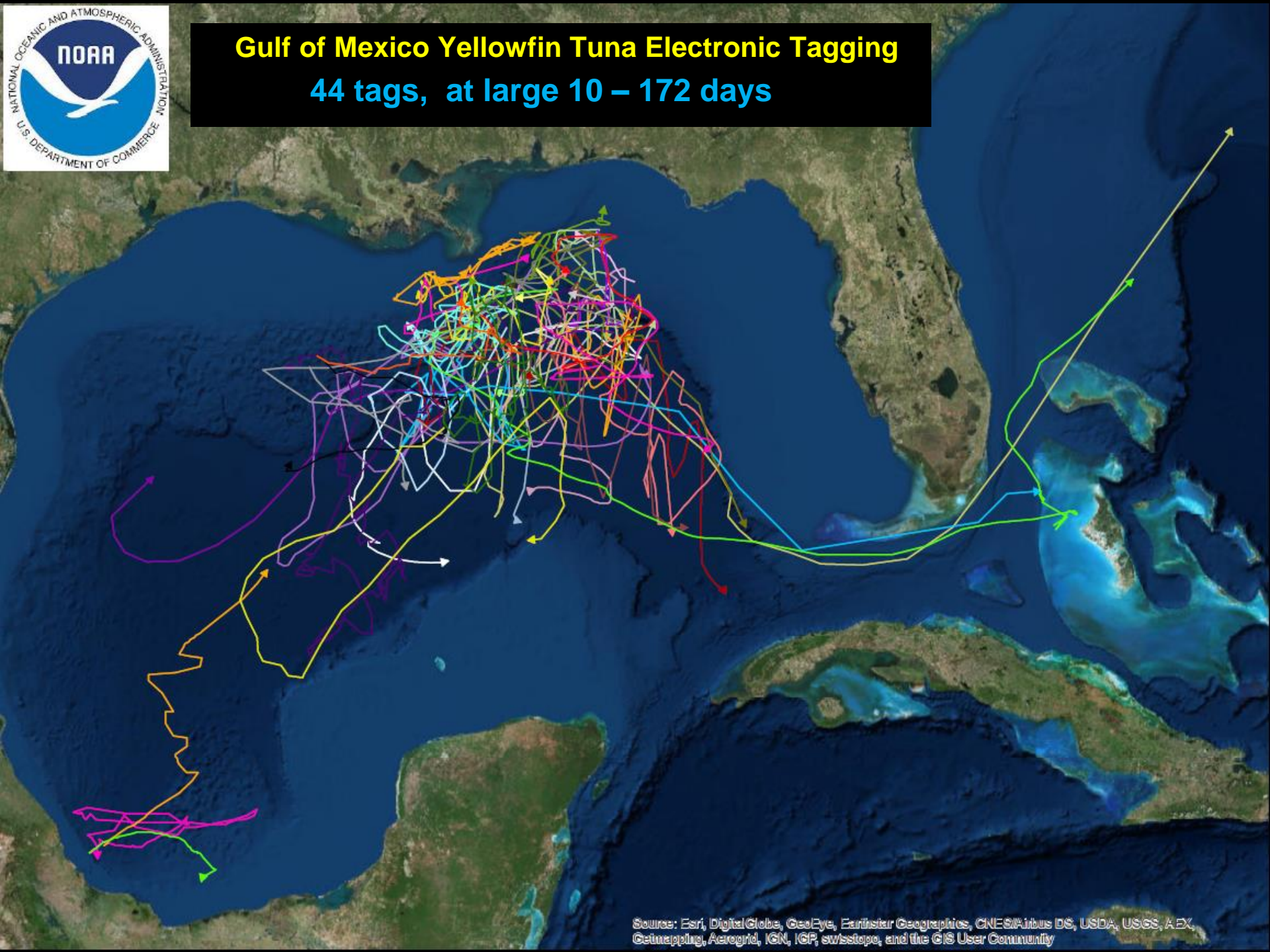
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Yellowfin Tuna

Update on electronic tagging research

Gulf of Mexico Yellowfin Tuna Electronic Tagging
44 tags, at large 10 – 172 days

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Yellowfin Tuna Electronic Tagging outside of the GOM

8 Tags deployed 2014-2015

at large: 4-99 days

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Swordfish

- Portuguese pelagic longline observers have begun deploying Popup Satellite Archival Tags on swordfish as part of a

  U.S. – Portugal collaborative study to collect data on habitat and stock structure